RELATION OF SELECTED SOCIO-ECONOMIC FACTORS TO DIETARY INTAKE AND DIETARY PATTERNS IN THE DOMINICAN REPUBLIC

by

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INTRODUCTION

> "In developing Caribbean countries, where the major tropical diseases largely have been eradicated, those disorders whose origins lie in poverty, lack of knowledge or in local cultural factors are assuming an increasingly important role. Malnutrition in childhood is one such disorder and, although it is almost certainly declining, it is doing so much less dramatically than the infections." (Desai, 1968)

Malnutrition per se is due to an inadequate intake of nutrients. But dietary intake is recognized as being only one of many environmental factors affecting the nutritional status of adults, particularly children. Those factors can be summarized as interrelated influences of diet, disease, and socio-economic background. The interactions are complex and the contributions made by each factor to the widespread problem of malnutrition are not completely understood (Desai, 1968). Also, socio-economic factors seem to have a varying impact on nutritional intake which differs by country and developmental status. An understanding of these interrelationships may provide a better basis for nutrition education and thus, prevention of malnutrition.

In the present study, the influence of selected socio-economic factors on dietary intake was investigated. The data were derived from a study conducted in 1983 in the Plan Sierra area of the Dominican Republic.

The objectives of this project were as follows:

1) to identify malnutrition, dietary and socio-economic differences among the three climatical zones in the study area,

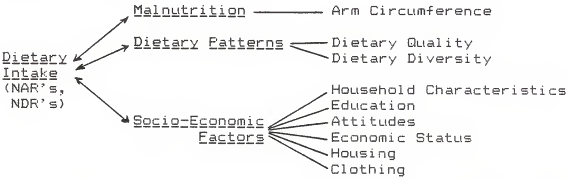
2) to study the relationships between assessed malnutrition and dietary intake,

3) to examine relationships among dietary quality, dietary diversity, and dietary intake; and

4) to analyze the relationships between dietary intake and selected socio-economic variables.

The following model illustrates the relationship between the variables under study:

Zone (dry, semi-humid, humid)



REVIEW OF LITERATURE

The Dominican Republic

The Dominican Republic constitutes the eastern two-thirds of the Caribbean island of Hispaniola. A mild tropical maritime climate prevails with temperatures between 0^{o} C and 32^{o} C and an average of 25^{o} C. About two-thirds of the country, primarily in the west, consists of highlands. This western area is more arid than the very humid slopes in the northeast. Most of the undeveloped brush and forestlands as well as many of the irrigated estates are found in the west.

The total population was estimated in 1980 at 5.6 million, which amounts to one of the highest density rates in Latin America. Fifty-one percent of the population are living in urban areas, the largest of which is the capitol, Santo Domingo. The annual growth rate is 2.5%, based on a birth rate of 45.8 per 1000 inhabitants. The infant mortality rate is 67 per 1000 live births (1984).

The original inhabitants, the Taino Indians, were almost completely annihilated through harsh treatment as forced laborers by the Spanish. Negro slaves were imported from Africa between the sixteenth and the eighteenth century to continue the work in mines and on plantations. The present population is predominantly mixed (73% mulattoes).

The official language is Spanish. Since 1844 the Dominican Republic has been independent. It is one of the lower middle-income countries of the world with an economic growth of 5.3% in 1979 (Encyclopedia of the Third World, 1978; May, 1973; Population Reference Bureau, 1984; United States Department of State, 1981; World Almanac, 1981).

The Dominican economy is mainly agricultural. Agriculture employs 57% of the labor force and contributes 21% to the Gross Domestic Product (GDP) and 75% to the export earnings (Encyclopedia of the Third World, 1978). The agricultural production is not so heavily export oriented that it fails to supply most of the consumer needs of the home market (Encyclopedia Americana, 1980). This is a problem of its Caribbean neighbor states, where the former plantation economy still continues. During the time of slavery it was more profitable to feed the slaves imported foods than to produce staple foods. Even today some countries still import up to 50% of the energy and protein supply (Cook, 1976; Jelliffe, 1969a).

Under the 1962 Land Reform Law, land distribution and resettlement were undertaken. But still, nearly 50% of the farms are smaller than 1 hectare in size and they account for less than 6% of the total farm land (Encyclopedia of the Third World, 1978). In 1971 half of the total cultivated land was worked for subsistence farming (Collier's Encyclopedia, 1979). The main crops in the Dominican Republic are sugar, cacao, coffee, tobacco, and rice.

In the mountainous region southwest of Santiago, the second largest city in the Dominican Republic, an agricultural program, called 'Plan Sierra', is located. The Plan Sierra is an integrated rural development project, created in 1979 by the government (Smith, 1982). The region, containing 120,000 people, has been considered one of the most ecologically fragile and economically deprived in the country. Not much agriculture is reported in this area (May, 1973). The objectives of the Plan Sierra are to stop erosion and conserve the natural resources of the region, and to improve the standard of living of the people. Programs of land management, agriculture, education, and health were implemented, and in 1980 a nutrition survey was conducted to obtain information needed to design a nutrition program (Smith, 1982).

Important Nutrients in Developing Countries and Dietary Study Methods

Protein calorie malnutrition (PCM) is the most important public health factor in underdeveloped countries. It is largely responsible for the fact that in many areas up to half of the children born do not survive to the age of 5 years (Davidson, 1979). Adults with protein calorie malnutrition have less energy for productive activity, and are more likely to lose work time due to illness then well nourished adults. Poor maternal diets can traumatize children, perhaps irreversibly, and start the viscious cycle

that leads to undernourished adults (Taylor, 1976). The most important fat-soluble vitamin in causing deficiencies in developing countries continues to be vitamin A, although most deficiency diseases are now largely controlled (Leitzmann, 1977).

Recent studies have shown not only that vitamin A deficiency is a major problem, especially in children, but also apparent associations between vitamin A deficiency and anemia (Majia, 1977), and between vitamin A and protein exist. An increase in vitamin A storage was seen in rats, as the quantity and quality of the diet protein improved (Ahuja, 1980).

Many different methods can be used to measure the dietary intakes of individuals and groups (Nesheim, 1981; Smiciklas-Wright, 1984). The principal methods are:

1) Dietary recall. The subject recalls food intake during the previous 24 hours or 1-7 days.

2) Food records. Individuals keep records of their food intake by weights, household measurements, or estimated quantities over a specific period of time.

3) Dietary history. An interviewer uses 24-hour recall or repeated food records, to determine usual eating patterns over a relatively long period of time.

4) Food frequency. Interviewer or subject records the number of times a food is eaten during a specific period of time.

5) Weighed intake. All food eaten during a given time period is weighed and nutrient intake is calculated from food tables or determined by laboratory analysis.

The most commonly used method is the 24-hour dietary recall. In an early study, comparing dietary history vs. seven-day record vs. 24-hour recall, Young (1952) determined that the 24-hour recall could provide data independent of the age, social status, and education. These results have been reported more recently by Gersovitz (1978), Morgan (1978), and Raesaenen (1979). Gersovitz (1978) reported no significant difference among mean recalled intake and mean actual intake of anlysis of grouped data. The reverse is true for the assessment of individual dietary intakes based on 24-hour recalls. In general, there is a tendency to over-report low individual intakes and under-report high intakes (Young, 1981). This is the 'flat slope syndrome' described by Nesheim (1981) and Sanjur (1982). When applied to a large population group, the 24-hour recall is a suitable method for depicting the food intake of a group (Nesheim, 1981), since its reliability and validity are
0-9
proved and generally acccepted.

Dietary Patterns and Dietary Intake

The prevailing pattern of food intake in the Dominican Republic is generally three meals per day. Rice predominates, usually combined with beans. Ninety-two percent of the families in the Sierra ate both foods daily (Smith, 1982). Other foods frequently consumed are bread, spaghetti, starchy root crops, sweet potato, yucca, plantain, and cassava. Beef is eaten less often. Eggs were

reported as frequently consumed, while fruits, other than sweet bananas, were seldom mentioned (Smith, 1982). Sebrell (1972) found in his study of the entire country a low consumption of eggs, but a high consumption of fruits. Beverages are coffee, heavily sugared, as well as chocolate or a milk drink made by mixing sweet potato or green plantain with milk.

In other Caribbean countries wheat flour and its products provide by far the largest proportion of total energy and protein of all food groups (Mayers, 1982). In Jamaica, dark sugar, wheat flour, and cooking oil are the major sources of dietary energy of the poor. As people become more affluent, rice becomes their largest source of energy. Wheat flour and rice were also the major suppliers of protein to all but the richest people in the Jamaican population. Those two foods are followed by roots and starchy fruits (Mayers, 1982). In the early 1970's some Caribbean countries began to enrich foods, such as sugar, with vitamins, for example vitamin A (Valverde, 1981). But the Dominican Republic belongs to those countries which have not yet fortified food with vitamin A (Lineback, 1979).

In 1969 Sebrell conducted a nationwide nutrition survey in the Dominican Republic. This work included 148 families, selected at random, 40% urban and 60% rural (Sebrell, 1972). The food intake was determined by weighing intake which was later on chemically analyzed. The results differed from region to region. The nutrient consumption was calculated

and expressed as a percent of the consumption recommended by the Institute of Nutrition for Central America and Panama (INCAP) as follows: calories 76%, protein 81%, calcium 62%, iron 76%, vitamin A 47%, riboflavin 55%, niacin 67%, vitamin C 75%, folic acid 71%, and vitamin B_{12} 30%. Twenty-nine percent of the households consumed less than two-thirds of the INCAP recommended intake for calories, while 36% had less than two-thirds of their recommended protein intake, and 70% had less than two-thirds of their recommended vitamin A intake. The average daily per capita intake was 1634 kcal, 55g protein, and 283 mcg vitamin A. Based on these findings and clinical and anthropometric examinations, Sebrell concluded that among preschool children the most crucial nutritional problem appeared to be calorie and protein deficits.

In another survey, conducted by Klipstein (1973) on 42 adults in Barrio Cabretto, a rural area in the south of the Dominican Republic, the three-day recall showed an average daily consumption of 1448 kcal (approximately 68% of the INCAP recommendations), and 35 g protein (64%). The Encyclopedia of the Third World (1978) listed a mean national daily per capita intake of 2158 kcal (95% of the requirements), and 44.7 g of protein (121% requirements). Reutlinger (1980) reported 89% of recommended caloric intake. Thus, there is little concordance in the nutritional adequacy data. Caloric intake ranged from 62% to 95% and protein from 72% to 121%. The lack of agreement may be attributable to differences in areas surveyed, year of

survey, and different reference recommendations (e.g. FAO and INCAP) used. In addition, estimations were not based on actual nutrient intakes, but on crude calculations of agricultural production. Overall the survey results indicate that average caloric and protein intake in the Dominican Republic are below the recommendations.

Surveys in other Caribbean countries showed similar findings. Gupta (1981) used a five day inventory or food account technique in addition to direct weighing to study the dietary intake of 2510 households and 13,622 individuals. The results were satisfactory in Barbados, Trinidad, and Tobago, where the average intake of all examined nutrients exceeded the requirements. Despite this, of all examined countries, an average of 60% of the households failed to meet their requirements for energy, 45% for protein, and 40% for vitamin A. Hence, reporting average nutrient intake or intake/requirement may not reveal the extent of malnutrition (Gupta, 1981). In a review of several nutritional studies in Central America, Majia (1977) concluded that 66%-88% of the families consumed less than half of the needs based on several international standards.

Since the major deficits in the diets of Caribbean countries are protein and calories (Mayers, 1982; Sebrell, 1972), and because protein-calorie-malnutrition (PCM) is the most common form of undernutrition, the following discussion will relate to those nutritional problems. Furthermore, because PCM and viamin A deficiency have been found to be

associated (Gupta, 1981; Majia, 1977; Sebrell, 1972), a discussion of vitamin A also will be included.

Araya (1981) evaluated typical Guatemalan dishes with respect to nutritional characteristics and more effective combinations and utilizations of the available foods. The results showed that an increase in the proportion of beans in a corn and beans mixture led to an increased availability of protein, iron, thiamine, and riboflavine. The corn-bean combination of 50:50 had a Net Dietary protein Energy percent (NDpCal) of 7.4 which is slightly inferior to the value of human milk. This researcher concluded that by eating only small amounts of expensive animal proteins the people could economically improve the biological efficiency of the foods they consumed.

Incidence of Malnutrition

The prevalence of malnutrition in the Dominican Republic is reflected in the high infant mortality rate (67 per 1000 live births; Population Reference Bureau, 1984) and in the high mortality rate for children between 1 and 4 years of age (6.0 per 1000 (1970); United Nations, 1984). Classical nutritional diseases such as scurvy, beriberi, and pellagra were seldom encountered by Sebrell (1972) in the Dominican Republic. But the majority of the people examined were chronically undernourished almost from birth. Of 1100 children examined (aged 0 to 5 years), 27% fell into class

II (23%) and class III (4%) of the Gomez classification of nutritional status. The Gomez classification of the degree of malnutrition according to percent standard weight is as follows:

Classification	% NCHS* standard weight	malnutrition (PCM)
Normal	91 or above	
Grade I	76 to 90	mild
Grade II	61 to 75	moderate
Grade III	60 or below	severe

* = National Center for Health Statistics

Clinical observations showed furthermore, that among the 5,512 subjects examined (all ages) only 39% were free of any lesions attributable to nutritional deficiency. The incidence of nutritional lesions increased with age.

In a study of children less than 5 years of age, SMITH (1982) reported that 10.1% fell into class II and 2.2% into class III malnutrition according to the Gomez classification (n=448). This was significantly less than the percentages found by Sebrell.

Depending on the anthropometric measurement and the standard used, varying degrees of undernutrition have been reported in the Caribbean and Central America (Table 1). Anderson (1979) found a range of 1.6% to 18.8% (n=1930) of malnourished children (1-5 years) in the Dominican Republic. For Columbia she reported 0.5% - 28.9% (n=1412), for Costa Rica 3.6% - 25.2% (n=730). With the arm circumference measurement she found 3.5% children classified as moderate and severely malnourished in the Dominican Republic; 5.4% in

Columbia, and 1.2% in Costa Rica. In Guatemala 25.8% of 62 children (1-5 years) were classified as Grade II and 3.2% as grade III, according to Gomez (Pigott, 1979). In Jamaica one-third of all young children showed moderate protein-calorie malnutrition by anthropometric measurements,

Table 1: Findings of undernutrition with different measurements in 1-5 year old children in Caribbean and Central American countries

Measurement	Country	Author	Findings
wt/age	Dom.Rep.	Sebrell'72	27% Gomez II & III
clinic.obs.	Dom.Rep.	Sebrell'72	61% have lesions*
wt/age	Dom.Rep.	Smith'82	12.3% Gomez II&III
wt/age	Dom.Rep.	Anderson'79	10.6% Gomez II&III
90% wt/ht	Dom.Rep.	Anderson'79	11.1%
80% wt/ht	Dom.Rep.	Anderson'79	0.5%
AC**	Dom.Rep.	Anderson'79	3.5% mod.& severe
wt/age	Columbia	Anderson'79	11.5% Gomez II&III
90% wt/ht	Columbia	Anderson'79	25.2%
80% wt/ht	Columbia	Anderson'79	3.6%
AC	Columbia	Anderson'79	5.4% mod.& severe
wt/age	Costa Rica	Anderson'79	9.0% Gomez II&III
90% wt/ht	Costa Rica	Anderson'79	18.6%
80% wt/ht	Costa Rica	Anderson'79	1.6%
AC	Costa Rica	Anderson'79	1.2% mod.& severe
wt/age	Guatemala	Pigott'71	29.0% Gomez II&III
wt/age & AC	Jamaica	Jelliffe'69	approx.33% mod. PCM
	"Caribbean"	Mayers'82	1.4% in imminent danger of death 12% definitely underweight 40% in borderline condition

* : all age-groups
**: AC = arm circumference (<13,5 cm, equivalent to moderately (yellow) and severly (red) malnourished, see p.18)
mod. = moderate

particularly weight-for-age and arm circumference (Jelliffe, 1969a). A more general statement about malnutrition in the Caribbean was made by Mayers (1982). He reported that 1.4% of preschool children (1-5 years) were underweight and in imminent danger of death. A further 12% were definitely underweight, and 40% in a borderline condition.

Not only is undernutrition a form of malnutrition, but also overnutrition. The previously cited studies also reported some degree of overnutrition in the Dominican Republic and Latin American countries. Smith (1982) found 6.5% obese children (>110 NCHS standard) in her sample and Anderson (1979) reported an incidence of 5-7% overweight children and 1-2% obese children in her samples in the Dominican Republic, Columbia, and Costa Rica. Thus the percentage of overweight children is approximately half of that reported for undernourished children in each instance. This points out, that not only undernutrition is a problem in those countries, but obesity is increasingly becoming a problem as well (Anderson, 1979; Smith, 1982).

In summary, malnutrition is a major health problem in the Caribbean, although the evidence is conflicting, and not always comparable. The Dominican Republic, however, appears to have a lower incidence of undernutrition than other Caribbean or Central American countries.

Reliability of Arm Circumference Measurements for Assessing Malnutrition

Arm circumference measurement is based on the principle that arm circumference reflects the soft tissue mass of the body and thus, reflects protein calorie malnutrition (PCM). Arm circumference increases only very gradually during the second to fifth year and differences between sexes are small. A "year-constant" standard of 16.5 cm was suggested by Jelliffe and Jelliffe (1969b). Arm circumference expressed as a percentage of this standard (Table 2) has been used to determine degrees of malnutrition (Shakir, 1974).

Table 2: Classification of malnutrition with arm circumference measurements as percentage of the standard

Nutritional status	% of the standard arm circumference	arm circumference
normal	over 80%	> 13.5 cm (green)
moderate malnourished	between 75% and 85%	12.5-13.5 cm (yellow)
severe malnourished	less than 75%	< 12.5 cm (red)

These measurements, which can be very helpful when ages of children are unknown, are used as a public health indicator of PCM. Although this simple and inexpensive measurement has been used widely, Jelliffe suggested in 1969 that it should be employed , whenever possible, with other parameters including weight. Shakir (1975) found a correlation coefficient of 0.92 between the Boston weight for age

standard and the arm circumference of 777 Baghdad children. Weight for age could be predicted from the arm circumference within ± 16%. When arm circumference, rather than weight for age, was used to differentiate well nourished from malnourished children, there was a misclassification rate of 2.2% for malnourished children classified as normal and 17.3% for normal children classified as malnourished (Shakir, 1975). Shakir considered this as "in favor of the child". A study conducted by Velzeboer (1983) showed correlation coefficients between arm circumference and weight for age of 0.71 and between arm circumference and weight for height of 0.97. The results of this study suggested that arm circumference is a good surrogate for the more commonly used weight for height and weight for age. It should be used in poor areas where severe malnutrition is prevalent and resources limited. However, Velzeboer (1983) also found that the correlations between arm circumference and other anthropometric measurements in Latin America were consistently lower. This was corroborated by Anderson (1979) for the Dominican Republic, who suggested that because of the occurance of milder malnutrition in Latin American countries compared to other countries, the 13.5 cm cut-off point was too low. Only severe malnutrition was identified by the current standard.

Socio-Economic Factors Associated with Dietary Intake

Payne (1977) expressed the opinion of contemporary researchers as follows:

> "By far the strongest and most insistent theme ... will be that it makes better practical sense to regard malnutrition as a condition arising basically from social and economic causes, rather than simply to describe it in terms of immediate shortages of particular nutrients."

The influence of social, cultural and anthropologic factors on malnutriton and nutrition in general have been studied increasingly since Margaret Mead's early reports (Mead, 1945). Household size, marital status of the parents, dominance by one of the parents, spacing of pregnancies, lack of maternal care, age of the mothers, care by the grandmothers, play an important role in the nutritional status of the family, especially the children.

The typical household in the Dominican Republic is a nuclear family. Changes in household composition are frequent (Brown, 1977). An important principle is that it is undesirable to live alone. Thus, for the Dominican Republic the typical rural household is reported by Brown (1977) to be composed of a couple and six children, by Sebrell (1972), as 7.6 people per rural household, and 6.9 on a national average, and by Smith (1982) as 6.4. The influence of increasing household size on the adequacy of the diet is reported to be detrimental. With fewer than four people in the household, nutrient intake met INCAP dietary recommendations; with over 10 people it was reduced to 50 percent of

the recommendations (Sebrell, 1972). Similar findings were reported from Guayana and Trinidad (Gupta, 1981).

Marriage among slaves was forbidden in Jamaica until 1826. This was probably true for the situation in all Caribbean countries and still effects the life of the people today. Appropriately, Clarke (1957) entitled her West Indian sociological work 'My mother who fathered me'. Attitudes towards marriage in the Caribbean are different from these in most developed countries (Desai, 1970) and marriage remains a status symbol for many people. Concubinage and illegitimacy are thus found among many lower middle class households (Clarke, 1957). A substantial proportion of all births (60% in the Dominican Republic; Sebrell, 1972) occur in a context of unions which do not last for long. Later on the father might support the child (Lewis, 1963), although usually irregularly and in small amounts. Thus, the mother needs to be employed and the grandmother takes care of the children. Desai (1968) found that when the mother was not married, younger, extremely poor, had short intervals between pregnancies, or lived in a large household, her childrens' physical growth was impaired as compared to growth of children from more favorable environments. However, Brown (1977) found in the Dominican Republic that women-centered households were better off in terms of quality of food, shelter, health, and psychological well-being, than male-headed households. In a study in Santo Domingo, the capital of the Dominican Republic,

MacCorquodale (1977) found that more mothers of malnourished children had been abandoned by their partners than mothers of the healthy children. In families where women were more dominant, the fertility rate increased (Belcher, 1976). These circumstances might have a substantial effect on both household size and nutritional status.

Education influences the degree to which a person is exposed to ideas beyond his immediate environment. Thus, the educational status of parents influences their awareness, the education of their children, and their living conditions. Schooling in the Dominican Republic is free and compulsory for seven years (from 7-14 years of age) and it can last for 12 years (Encyclopedia of the Third World, 1978). Studies in the Dominican Republic showed a negative relationship between the educational level of the parents or the attendence of their children at school and malnutrition of the children (MacCorquodale, 1977; Smith, 1982). But schooling itself is affected by irregular attendance, out-of-date teaching methods, and shortage of teachers, equipment, and accommodations.

Irrespective of the educational level of the parents, ignorance of how to improve their situation seems also to be related to malnutrition in children. A study in Mexico indicated that despite the lack of association between malnutrition and illiteracy or education of the mothers, the frequency of listening to the radio as well as the degree of emotional and cognitive stimulation for the children was

indeed associated with malnutrition (Cravioto, 1973). This suggested that the quality of the emotional bond between mother and well-nourished child might have been stronger then the bond between the mother and the poorly nourished child. A similar study in Santo Domingo found similar results but less strong relationships (MacCorquodale, 1977). Despite the same educational level, mothers with healthy children were reading newspapers significantly more frequently and showed more concern for the health of their children. However, further investigations showed that these mothers had higher incomes. This suggested that family income was an important determinant of preschool malnutrition and played a more important role than did the educational level of the parents.

Low income or poverty is said to be one of the major factors influencing nutritional intake and thus malnutrition. Caribbean people have a low purchasing power, although they are not at quite the same level of poverty as some other areas of the world. The rural Dominican population shows a great homogenity. Ninety-five percent of the population fall into class V of the Hollingshead Index of Social position (Belcher, 1976). The average income for a household with 8 members was reported by Brown (1972) as US $ 850, and for a 4 person household as US $ 450. The Gross Domestic Product per capita was US $ 910 in 1978 (Encyclopedia of the Third World, 1978). Expenses are estimated by Brown to be approximately US $ 100 per person per

year for subsistence or household maintenance. In the rural area the husband works 0.5 hectares of his own land and/or sharecrops 1 hectare with a large landholder (Brown, 1977). Smith (1982) found that 80% of the farmers had holdings averaging 1.3 hectares, while farmers with the largest holsings (20%) had an average of 19.6 hectares. In Jamaica the mean amount of cultivated land in the research area was 0.8 hectares, and 10% of the families owned 2.8 hectares or more.

Smith (1982) reported that malnutrition was found associated with poverty in the Dominican Republic. With increasing income an improvement of energy and protein intake was found in Trinidad (Gupta, 1981). However, the discussion of whether or not income is the number one cause of malnutrition continues. Studies in Puerto Rico showed that social variables were more important than economic factors in determining the level of living of rural inhabitants (Belcher, 1977). Similar studies conducted in the Dominican Republic suggested that a sufficient income above that needed for food must be attained, before lifestyle and level of living improve (Belcher, 1977). MacCorquodale (1977) supported the previous finding that in the Dominican Republic income indeed is a more important factor of preschool child malnutrition than sociologic factors.

Houses in the study area are generally built with wood siding (92.8%), metal (52.9%) or thatch roofs (35.8%), and cement (61.0%), dirt (21.2%) or wood floors (17.2%) (Smith,

1982). Ten years ago homes were reported to consist largely of bamboo with palm thatched roofs (Sebrell, 1972). Housing conditions may have improved as they have in Jamaica, where concrete block structures are replacing wooden and wattle-and-daub houses and shacks (Desai, 1970).

Summary

The Dominican Republic belongs to one of the middle income countries of the world, still attached to its history. Food intake has been reported to be inadequate primarily in protein, calories, and vitamin A. Studies of caloric, protein, and vitamin A intake have mixed findings, ranging from 62-95% of the recommendations for calories, 72-121% for protein, and 47% for vitamin A. The custom of consuming beneficial food combinations does have a positive influence on nutrition; for example, the consumption of rice with beans, and vitamin A rich foods with protein or fat.

Mild undernutrition exists for all age groups in the Dominican Republic. Nutritional lesions were found from birth on with the frequencies increasing markedly with advancing age. Children aged 1 to 5 years, however, are the most vulnerable group. Reports about their malnutrition rates range from 0.5% to 27%, depending on measurement and standards. Compared with other countries, the Dominican Republic still compares favorably regarding the incidence of malnutrition.

Socio-economic factors influence nutrition all over the

world. Studies in the Dominican Republic showed that increasing household sizes led to an impairment of nutritional status. The educational background of parents affected not only the school attendance of their children but with increasing education of the parents, the children's malnutrition decreased. In addition to education, awareness about the family's situation has a slight posititve influence on the nutritional status of the children. The greatest influence on the nutritional intake in the Dominican Republic is income. Although studies in other countries indicate a higher influence of sociologic factors on malnutririon than income, these findings are not corroborated in the Dominican Republic.

Assessments of malnutriton with the arm circumference measurement alone may not to be reliable in Latin America. However, for fast and inexpensive identification of moderate or severe malnutrition in large samples, the Shakir Strip is acceptable.

In general, in studies which concern the relation of malnutrition and sociologic factors, malnutrition is mainly determined by anthropometric measurements. Only rarely is the actual nutrient intake, expressed in its percentages of recommendations, used in an analysis of the effect of socio-economic factors on nutritional status. Hence, in the present study nutrient intake was analyzed in relation to these factors. Additionally, to understand more about the nutrient intake and dietary patterns, two supplementary variables

were established: dietary diversity and dietary quality. The combination of these variables should extend our knowledge about the relationship between dietary factors and socio-economic variables in the Dominican Republic.

METHODOLOGY

Data Collection

A survey was conducted in 1983 in the Dominican Republic to study poverty in the region influenced by the Plan Sierra. The area was divided, by the researchers, into three climatic zones: dry, semi-humid, and humid. A total of 41 communities in all 3 regions were surveyed. Interviews with 1103 rural women and arm circumference of each child 1 to 5 years of age in the household was measured. The questionnaire was developed by the Dominican researchers under the guidance of Dr. M. F. Smith. All data were collected in the home by trained interviewers.

The questionnaire included items about:

- the household: size, age-distribution;
- housing conditions: roof, wall, and floor material;
- clothing of children;
- schooling: number of illiterates, attending school, years completed, reasons for not attending school;
- income, expenses, and land holdings;
- attitudes and awareness about their situation.

Data analysis was conducted in the Foods and Nutrition Department and the Statistical Laboratory at Kansas State University. Only the socio-economic and dietary intake variables will be reported here. The socio-economic

variables available were household composition (age-distribution), education, income, land holdings and expenses, occupation, housing, and clothing.

Data Management

All 119 variables from the initial 1103 interviewed households were read into the computer. When more than one answer was given per variable either the first one was used or a new answer-category was created. The 27 households that did not record any food consumption were eliminated from the data set. Three households had to be eliminated because of unreliably high amounts of certain food items. This reduced the sample to 1073 households. Of the remaining households 339 were in the dry zone, 370 in the semi-humid zone, and 364 in the humid zone.

Calculation of Household Dietary Intake

Interviewers were trained to record the amount of all food consumed by each household during the past 24 hours. Amounts given in ounces were converted into grams and for each food item, energy (kcal and kJ) and the intake of protein (g) and vitamin A (mcg retinol) were calculated and then summed for each household. Nutritive value for most foods was obtained from the INCAP 'Food-Composition Tables for use in Latin America' (INCAP, 1961). For those few

foods not found in the INCAP tables, the USDA Composition Tables (USDA, 1963 and 1976) were used. The ingredients of traditional food mixtures were identified with the aid of a Dominican cookbook (Bornia, 1979).

Calculation of Household Recommended Intakes

Values for recommended dietary allowances for each age and sex group were taken from the values recommended by the Officina Nacional de Planification (UPAN, 1977). The values are based on FAO-recommendations for low-income populations consuming little or poor quality protein (FAO, 1974). Because the sex-distribution for adolescents and adults was not known, recommendations for both sexes were averaged for each age group. This was done according to demographic Census Data (United Nations, 1984) which reported an approximate 50:50 distribution (range 47.41 - 52.59) for the adolescent and adult population in the Dominican Republic. Protein, caloric and vitamin A needs of all household members were summed to yield a household recommended intake for protein, for calories, and for vitamin A.

Nutrient Adequacy Ratios, Mean Adequacy Ratios, and Nutrient Density Ratios

Household Nutrient Adequacy Ratios (NAR) for energy, protein and vitamin A for the total household were obtained as follows:

$$NAR = \frac{\text{amount of nutrient in household food intake}}{\text{household recommendations for nutrient}} \times 100$$

For some of the final analyses the Mean Adequacy Ratio was used. The MAR was an average of all three of the NAR's. The NAR's were truncated at one-hundred, so that an excessive intake of one nutrient would not compensate for an inadequate intake of another nutrient. The formula is:

$$MAR = \frac{\text{Sum of Nutrient Adequacy Ratios (NAR's)}}{\text{Number of Nutrients}}$$

Nutrient Density Ratios (NDR) for each household were obtained with the formula:

$$NDR = \frac{\text{nutrient in diet / kcal in diet / 1000 kcal}}{\text{recommendations for nutrient /recommend. for kcal/1000 kcal}}$$

If the nutrient density of a specific nutrient in the diet (numerator) is equal to the nutrient density of the recommendations of that specific nutrient (denominator), the NDR is equal to 1.0.

Dietary Quality and Dietary Diversity

To further describe dietary patterns two additional variables, dietary quality score and dietary diversity score were established. According to Sanjur, (1982) and Caliendo (1978) a dietary quality score is based on the extent to which a diet in one 24-hour recall period satisfies the Four Food Group pattern. The dietary pattern was adapted to three groups, since this is the number used in most developing countries. The groups were construction or protein rich foods, protection or vitamin rich foods, and energy or high caloric foods.

The food reported in the 24-hour household recall was classified into the three food groups according to a publication of the Secretary of Health of the Dominican Republic (Nova, 1980). An Index of Nutritional Quality (INQ) was calculated for each food to faciliate classification of each food into one of the three food groups. The food groups are listed in Appendix 1. The standards for the INQ's were based on the FAO recommendations for the Dominican Republic and the age-distribution of the sample. The formula for the INQ (Sanjur, 1982; Hansen, 1973) is as follows:

$$\text{INQ} = \frac{\text{amount of nutrient in food / kcal in food}}{\text{allowance for nutrient / kcal allowance}}$$

An INQ of greater than one indicates that the food provides a beneficial nutrient to energy ratio for that particular nutrient. A food with a value of greater than 1.5

is considered to be an excellent source of that nutrient. Thus an INQ above 1.5 for protein, vitamin A or ascorbic acid was used to classify a food into the construction or protection group, respectively. A fourth group was created for foods such as spices, coffee, and alcoholic beverages.

Patterns of dietary quality were designated after a complete tabulation of all combinations of frequencies of the three food groups. The number of occurrences of each food group served to differenciate patterns of dietary quality. The most frequently limiting factor, the protection group, was used as an additional distinguisher.
The classification was as follows:

- less than 1 food item from 2 food groups = pattern 1
- less than 1 food item from 1 food group (protection group) = pattern 2
- less than 1 food item from 1 food group (construction or energy group) = pattern 3
- only 1 food item from 2 food groups = pattern 4
- only 1 food item from 1 food group (protection group) = pattern 5
- only 1 food item from 1 food group (construction or energy group) = pattern 6
- 2 or more food items in any food group = pattern 7

A diversity score was calculated in order to obtain information about the variety of a diet. This concept is based on the Guttman Scale or scalogram analysis (Guttman, 1944). To determine the diversity score, the frequency of the 77 food items was tallied (Appendix 2) and condensed into a 11 item list of the 11 most frequently consumed foods (consumed by more than 20% of all households). These foods, in order of frequency of consumption, were: sugar,

rice, oil, beans, yucca, spaghetti/noodles, cows milk, oranages, eggs, bread, and bananas. Eleven foods were included on the list because no more than 11 items were recorded per household. The diet of each household was scored with one point assigned to the consumption of any item on the list. The diversity score ranged from 0 to 11. This score was used to compare only diversity, not the nutritive value of the household diet. No indication of individual food item quantity or nutritive value of the diet can be obtained from the dietary diversity score.

Arm Circumference

Interviewers were trained to measure arm circumference using the Shakir Strip. The Shakir Strip is a non-elastic band, marked with colors, which identifies levels of malnutrition. The red area goes from 7 to 12.5 cm, the yellow area from 12.5 to 13.5 cm, and the green zone from 13.5 to 17.5 cm. These distances refer to the standard established by Jelliffe (1969b). With this strip, the mid-upper arm circumference of children between 1 and 5 years of age can be measured, and the children classified as severely or moderately malnourished or as normal.

Explanation of Variables and Newly Created Variables

A new variable, color, including all three measurements of malnutrition, was created to be used in further statistical analyses. This variable represented the households (and not the number of children), according to their most malnourished child, measured with the Shakir Strip.

Income and expenses variables were categorized into intervals of 500 Dominican Pesos[1], ranging from less than 500 to 4000 Pesos. Property landholding categories intervals ranged from less than 10 tareas (0.63 hectares) to more than 1000 tareas (63 hectares). Information about clothing was only available for children below 9 years of age. The clothing-related variables were nude, barefoot, and torn clothing. Variables were created for the need for food, housing, and clothing, where the scores represented the rank the interviewed household attached to their need for improvements in each of the three variables.

The number of household members in a certain occupation also had to be merged into a new variable. The interviewer asked how many people per household were working in each occupation mentioned by the respondant. Since most households reported occupations of several members, the information had to be merged. The variable 'job' then represented the occupation of the greatest number of members in every household.

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1 : The Dominican Peso was at par with the U.S. Dollar at the time of data collection.

Statistical Analysis of Data

Statistical analyses were performed to describe the population and to show relationships among the variables, using the Statistical Analysis System (SAS, 1983). Statistical procedures were frequencies, means and standard deviations, percentages, Pearson and Spearman correlation coefficients, and the Chi-Square test. The Chi-Square statistic was used to evaluate whether or not empirically obtained frequencies differed significantly from expected ones (Blalock, 1972). Differences among the three zones, and the relationships between malnutrition and dietary intake variables (NAR's and NDR's) were examined using the Chi-Square test.

For the inferential analyses, Analysis of Variance, the General Linear Models Procedure, Chi-Square test, and regression analyses were performed. Analysis of variance (ANOVA) and the SAS General Linear Models Procedure (GLM) were used to test differences among means of more than two samples. ANOVA requires balanced data, whereas GLM can handle unequally distributed data. ANOVA was used to study the relationship among dietary intake and dietary pattern variables. The GLM procedure was used to look at the influence of the categorized independent socio-economic variables on the continuous dependent dietary intake variables (NAR's and NDR's), and to identify differences between the continuous variables among the three zones (zone as

independent variable). The procedure also was used to determine interactions among the independent socio-economic variables.

To analyze the influence of the continuous independent socio-economic variables on the dependent dietary intake variables, the simple regression analysis was used. Furthermore, for more information, multiple regression analysis was used with the same variables to predict a single dependent variable from any number of independent variables. This is a helpful analysis because it gives insight into the relationships between the independent and the dependent variables. Multiple regression was used to indicate how much of the total variation in the dependent variable could be explained by all of the independent variables acting together (Blalock, 1972; SAS, 1982). The SAS stepwise regression procedure was used to examine the effects of socio-economic variables on the NAR, NDR, and MAR values. The same procedure also was used to enter variables into the model according to their relative contribution to the NAR, NDR or MAR value.

RESULTS AND DISCUSSION

The results of the statistical analysis of the data will be presented in this chapter. First, the sample will be described, second, relationships between variables will be identified, and finally, the findings for the objectives will be discussed.

Descriptive Findings

The final sample in this study included 1073 households with 6686 persons. Fifty-four percent were adults, 16 years of age or older. This is the age at which people are considered to be productive and therefore adults (Gupta, 1981; Jerome, 1980). The average household had 6.22 members, including 3.36 adults and 2.86 children. Households in the dry zone were significantly smaller ($\bar{x}$=5.87 members) than the ones in the semi-humid ($\bar{x}$=6.31), and the humid zone ($\bar{x}$=6.50). The findings for the proportion of children were similar: significantly fewer children per household in the dry zone ($\bar{x}$=2.14) than in the semi-humid zone ($\bar{x}$=2.59), and the humid zone ($\bar{x}$=2.87).

Nutrition

Intake patterns

There were 77 different food items mentioned on the 24-hour household dietary recall. The percent of households which consumed each of the 77 food items is listed in Appendix 2. The most frequently consumed foods within each zone were: 1) sugar, 2) rice, 3) oil, and 4) beans. The foods which were consumed in the highest amounts per household were sweet potatoes, consumed by only 3.9% of all households, and yucca, consumed by 52.7%.

The mean amounts of the ten food items which were consumed in the highest amounts are listed in Appendix 3. Differences between the adjusted means ($p \leq 0.05$) are described by letters. The same letter under the means of two zones shows that there is a significant differnce between those two zones. The values are based only on those households which recalled the food. Most households (83.0%) consumed 7-11 food items. Highly significant differences in the number of food items consumed were found among the zones (Table 3). In the dry zone more food items were consumed ($\bar{x}=8.95$) than in the two other zones (semi-humid: $\bar{x}=8.29$, and humid: $\bar{x}=8.05$). The average was 8.4 food items per household.

Although the diversity score is also related to the number of food items recalled, the average diversity score (6.3) is lower than the average number of foods consumed (Table 3). This indicates, that most of the households had a low variety in their diet. Most of the households had a

Table 3: Adjusted means of nutritional variables and differences between zones

Variable	Zone: dry (A)	Zone: semi-humid (B)	Zone: humid (C)	p-value
number of food items	8.95 B** C**	8.29 A**	8.05 A**	0.0001
dietary quality	5.37 B	4.96 A C*	5.43 B*	0.0009
dietary diversity	6.44 B**	5.95 A** C	6.64 B	0.0001
NAR energy	79.76 C**	78.96 C**	97.62 A** B**	0.0001
NAR protein	92.06 C	87.89 C*	103.53 A B*	0.0032
NAR vitamin A	59.17 C	44.94 C	115.67 A B	0.0083
protein density	1.146 C	1.099	1.036 A	0.0041
vitamin A density	0.662 C	0.478 C	1.067 A B	0.0053

A-A, B-B or C-C : significant differences at the $p \leq 0.05$ level

*: $p \leq 0.001$

**: $p \leq 0.0001$

score between six and nine (81.1%), and only seven households (0.007%) had a score of 11. Significant differences in the diversity score were found between the semi-humid zone and the other zones. The highest average score was found in the humid zone (6.64) versus 6.44 in the dry and 5.95 in the semi-humid zone. The average number of food items consumed per household from each of the three food groups construction, protection, and energy, or the other groups, was 2.2, 1.6, 4.3, and 0.3 per household, respectively.

The semi-humid zone had lower dietary quality scores (4.96) than the dry (5.37) or the humid zone (5.43). Because all three zones seemed similar, further discussions will refer to findings together. Only 1.6% of the households consumed less than one food item from two of the food groups (pattern 1), and 17.9% had at least one food item from 2 groups (pattern 2 and 3) (Table 4). The patterns 1 to 3 can be considered as 'poor' diet, because one entire food group was lacking in the diet. This food group was, among the 'poor' diets, in 74.9% of the cases the protection group. The patterns 4, 5, and 6 found in 8.2%, 22.8%, and 9.2% of the households, respectively. These patterns can be considered as 'moderate' diets, because the people had eaten foods from all three groups, although the consumption seems to be unbalanced due to only one item from at least one food group. Among the 'moderate' diets, 56.7% had only one food from the protection group (group 2). A 'satisfactory' diet

with more than two food items in any of the three food groups was consumed by 40.2% of the households. Approximately 20% of the sample had a 'poor' diet, 40% a 'moderate' diet, and 40% a 'satisfactory' diet - based on the dietary quality score. None or only one food item from the protection group was reported by 37.4% of the households.

Table 4: Distribution of households according to established patterns of dietary quality

#	number of food items		food groups	% of households	diet quality
1	<1	from	2 groups	1.6%	
2	<1	from	1 group (2)	14.6%	poor
3	<1	from	1 group (1 or 3)	3.3%	
4	only 1	from	2 groups	8.2%	
5	only 1	from	1 group (2)	22.8%	moderate
6	only 1	from	1 group (1 or 3)	9.2%	
7	>2	from	any group	40.2%	satisfactory

a : 1 = construction, 2 = protection, 3 = energy

Twelve households recalled the consumption of alcohol (beer or rum). Those families consumed the alcoholic beverage in addition to their food, since their average number of food items was 9.5 (s=1.45). Their NAR values for calories and protein were above average, with a wide range, but the NAR for vitamin A was very poor.

Coffee was consumed by 15.9% of the households. The number was expected to be higher since Dominicans love coffee. Chi-Square analysis of coffee-by-income showed much higher than expected coffee consumption in the lowest income groups, whereas the highest income groups drank the least amounts of coffee.

Dietary Intake

All NAR values and the vitamin A density ratio were significantly higher in the humid zone. The dry zone had the highest average ratio for protein density with a significant difference to the humid zone. The semi-humid zone had medium scores.

Results of the dietary analysis are presented in Table 5. The mean caloric, protein and vitamin A consumption per household was 11,522 kcal, 268 g, and 2,682 mcg, respectively. Slightly less than one-fourth (24.3%) of the total protein originated from animal sources. Higher levels of animal protein intake were found in the semi-humid zone (25.9%), than in the dry zone (24.8%) or the humid zone (22.1%). Per capita consumption was 1858 kcal, 43.3 g protein, and 432.6 mcg vitamin A. This compares to reports of per capita daily intake of 1448 kcal, and 35 g protein (Klipstein, 1973); 1634 kcal, 45 g protein, and 283 mcg retinol intake (Sebrell, 1972). The protein intake deviates only from that reported by Klipstein. The vitamin A intake is 1.5 times greater than the one found by Sebrell.

The calculated average recommended intake for calories, protein and vitamin A per household were 14,547 kcal, 306 g protein, and 3,861.7 mcg vitamin A. Hence the Nutrient Adequacy Ratios (NAR's) for calories, protein, and vitamin A were 86.3, 95.3, and 74.1, respectively. Compared with Sebrell's findings (Table 6), the NAR for calories and protein were higher. Surprisingly Sebrell reported a slightly higher actual intake for protein than was found in

Table 5: Results of the dietary analysis, presented in means and listed by zones and for the total sample

	total (n*=1073)	zone: dry (n=339)	semi-humid (n=370)	humid (n=364)
actual intake:				
energy[1]	11,522.2	10,206.3	10,617.4	13,654.6
protein[2]	268.2	248.3	248.8	306.4
vitamin A[3]	2,682.4	1,961.7	1,441.8	4,550.7
recommendations:				
energy	14,547.0	13,835.2	14,740.7	15,015.8
protein	306.0	291.8	310.5	314.7
vitamin A	3,861.7	3,722.2	3,918.7	3,934.1
NAR's:				
energy	86.3	79.8	79.6	99.1
protein	95.3	92.1	88.1	105.5
vitamin A	74.1	59.2	44.8	116.2
NDR's:				
protein	1.0920	1.146	1.097	1.037
vitamin A	0.7406	0.662	0.478	1.067

* : n's for vitamin A are: 1050, 335, 352, 363
1 : measured in kcal
2 : measured in g
3 : measured in mcg

this study, but a lower NAR score. Actual vitamin A intake as well as the NAR in this study was 1.5 times that found by Sebrell (47). This is due in part to the fact that Sebrell used the INCAP recommendations which are approximately 9% lower for calories than the FAO recommendations used in the present study. When the dietary intake findings of Klipstein and Sebrell were adjusted to the FAO standards, the NAR's for calories and protein from both Klipstein and Sebrell were still lower than the ones found in this study. Differences in dietary findings may be attributed to the fact that Sebrell's study was conducted shortly after a civil war, whereas the data of the present study were collected after years of peace and of improved economic conditions.

Table 6: Findings of Nutrient Adequacy Ratios in Caribbean Countries

author	year[1]	country	NAR energy	NAR protein	NAR vit.A	recommendation
Sebrell	1969	Dom.Rep.	76.5 (69.7)	81.8 (91.1)	47.0 (45.4)	INCAP (FAO)
Klipstein	1973[2]	Dom.Rep.	68 (62)	64 (71)	-- --	INCAP (FAO)
Venhaus	1983	Dom.Rep.	86.3	95.3	74.1	FAO
Gupta	1970	Barbados	94	112	126	FAO
	1970	Trinidad & Tobago	122	128	167	FAO
	1971	Guayana	82	94	111	FAO

1: year of conduction
2: year of publication

For Barbados, Trinidad and Tobago, Gupta (1981) reported much better NAR's, mainly for vitamin A (Barbados, rural: 94 for calories, 112 for protein, 126 for vitamin A; Tinidad and Tobago, rural: 122, 128, and 167, respectively).

Only in Guayana were similar findings reported for calories (82) and for protein (94), and better findings for vitamin A (111). The average Protein Density Ratio was 1.09, and the Vitamin A Density Ratio was 0.74.

As family size increased, NAR decreased. The NAR for calories decreased from 107.4 for a family of <4 to 67.3 for a family of 9-12 members. Likewise the protein decreased from 118.1 to 72.7, and the NAR for vitamin A from 93.6 to 57.4. There was, however, a noteworthy improvement for the largest families (more than 13 members). Their NARs were 74.6, 83.2, and 202.9 for calories, protein, and vitamin A, respectively. Sebrell (1972) found the same decrease in the adequacy of a diet with increasing family size, although his NARs were lower, the decrease was greater, and he did not report an increase in the largest families. This increase might be explained by the fact that larger households have more people to work in the fields or in the garden, or to earn money.

The distribution of households, classified according to how well they met the recommendations for every nutrient and the density ratios are listed in Table 7. More than one-third (37.4%) of the households fell below 66% of the recommendations for caloric intake. While 36.4% of households fell in the range of 66% to 100% intake of the recommendations, and 26.2% exceeded the 100%. Protein findings were similar: 39.0% of the households had a protein intake less

Table 7: Distribution of households, according to percent of FAO recommendations for calories, protein, and vitamin A consumed

% of recommendations		total n=1073	dry (1) n=339	semi-humid (2) n=370	humid (3) n=364
	<66%	37.4%	42.8%	43.5%	26.1%
NAR	66-100%	36.4%	36.5%	34.1%	38.7%
energy	≥100%	26.2%	20.7%	22.4%	35.2%
	<66%	39.0%	40.4%	41.9%	34.6%
NAR	66-100%	26.5%	25.1%	27.8%	26.7%
protein	≥100%	34.5%	34.5%	30.3%	38.7%
	<66%	90.3%	90.6%	91.6%	88.7%
NAR	66-100%	3.8%	3.8%	3.8%	3.9%
vit. A	≥100%	5.9%	5.6%	4.6%	7.4%

than 66% of the recommendations, 26.5% fell between 66% and 100%, and 34.5% exceeded 100%. Slightly more households (8.3%) were above the recommendations for protein than for calories. For vitamin A, 90.3 % of the households fell below 66%, 3.8% in between 66 and 100% and only 5.9% exceeded the recommendations.

These findings were higher than those reported by Sebrell (1972). The percentage of households consuming less than two-thirds of the recommended intakes were: 29% (vs. 37.4%) for calories, 36% (vs. 39.0%) for protein, and 47% (vs.90.3%) for vitamin A. The lack of agreement can be explained, to some extent, by the difference between the INCAP and FAO recommendations. In general, approximately three-fifths of the households did not meet the recommendations for calories (62.6%) and protein intake (61.1%). The majority (94.1%) did not meet the recommendations for vitamin A.

Approximately 50% of the households had a protein density ratio less than 1.0 (50.3%), and 50% greater than 1.0 (49.7%) (Table 8). However, for vitamin A, 93.4% of the

Table 8: Distribution of households, according to above or below the Nutrient Density Ratio

above or below NDR		total	dry (1) n=339	semi-humid (2) n=370	humid (3) n=364
NDR protein	<1.0	50.3%	44.3%	48.9%	57.4%
	≥1.0	49.7%	55.7%	51.1%	42.6%
NDR vit. A	<1.0	93.4%	93.2%	95.9%	90.9%
	≥1.0	6.6%	6.8%	4.1%	9.1%

households fell below 1.0 and only 6.6% were above 1.0. Thus, the protein density in 50% and vitamin A in 93.4% of all household diets not was not satisfactory, and for vitamin A in 93.4% of the households.

Food Mixtures and Combinations

The synergistic combination of rice and beans yields a higher biological value of protein than either rice or beans seperately. Since it was the most frequent food combination in the Dominican Republic, reported by Sebrell (1972), and Smith (1982), the frequency of consuming both rice and beans, was examined. Although it cannot be determined if rice and beans were really consumed at the same time, that is the usual way to serve them. In this study 75.9% of all households consumed both rice and beans. In an earlier study, Smith (1982) reported 92% did so. Of all households which consumed rice, 84.0% also had beans. If they had beans, then 97.3% had also rice. Consequently beans were almost never consumed without rice, but rice was consumed separately in one-sixth of all households.

The use of vitamin A rich foods[2] with fats and oils, as well as of vitamin A rich foods alone and protein were studied. Vitamin A rich foods were consumed with fats and oils by 61.5% of all households. If a household consumed vitamin A rich foods, then 80.8% also had fats and oils. Of all households, 73.3% consumed protein rich foods (the foods

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2: based on an INQ for vitamin A above 1.5

in the construction group) and vitamin A rich foods. Only 63.6% of the households consumed high protein quality foods, such as meat, eggs, and dairy products, together with vitamin A rich foods. More households consumed high protein quality foods, including beans (95.4%) than animal protein foods (81.7%). Of all households that recalled vitamin A rich foods, 96.2% also recalled protein rich foods and 83.4% recalled animal protein foods.

In summary, three quarters of all the households reported consuming combinations of rice and beans, and vitamin A and protein rich foods. Approximately two-thirds reported using vitamin A rich foods and animal protein, and three-fifths vitamin A rich foods and fats and oils. Of the households who consumed either beans or a vitamin A rich food, 80-90% of them also consumed another beneficial complementing food.

Arm Circumference

Measurements of arm circumference using the Shakir Strip were obtained from 824 preschool children aged 1 to 5 years (Table 9). This represented 88% of the children in this age group or 54% of all households. The highest percentage of children who were severely (11.6%) or moderately malnourished (18.1%), were found in the humid zone. The lowest percentage was found in the semi-humid zone where only 5.4% of the children were severely, and 11.1% moderately malnourished.

Table 9: Malnourished and normal children (1-5 years of age) classified by arm circumference measurements with the Shakir Strip

zone	malnutrition			
	severe (red)	moderate (yellow)	normal (green)	total
dry (1)	10 * 4.4% ** 15.9% ***	36 15.9% 28.6%	180 79.6% 28.3%	226 27.4%
semi-humid (2)	14 5.4% 22.2%	29 11.1% 23.0%	218 83.5% 34.3%	261 31.7%
humid (3)	39 11.6% 61.9%	61 18.1% 48.4%	237 70.3% 37.3%	337 40.9%
total	63 7.6%	126 15.3%	635 77.1%	824 100%

* : frequency (n)
** : row percent (in %)
*** : colum percent (in %)

Arm circumference of sixty-three of the measured children (7.6%) fell into the red area of the Shakir Strip or less than 12.5 cm. This corresponds to less than 80% of the Harvard weight-for-age standard and is used to identify severe malnutrition (Shakir, 1974; Velzeboer, 1983). There were 126 (15.3%) children whose arm circumference was in the yellow or moderately malnourished area, and 635 (77.1%) in the green or normal area. These findings seem to compare favorably with Shakir (1975) and Velzeboer (1983), who reported relatively good correlation coefficients among weight for age (Gomez) and arm circumference. The percentages of severe and moderate malnutrition found by Smith (1982) were lower than the present ones (2.2% vs. 7.6% severe, and 10.1% vs. 15.3% moderate). The percentages found by Sebrell (1972) were lower for severe malnutrition (4% vs. 7.6%), but higher for the moderate form (23% vs. 15.3%). Anderson (1979) found that only 3.5% of the children were moderatly and severely malnourished.

The results for the aggregate variable color showed that this variable still represented the distribution of malnutrition. There were 498 households with children less than 5 years of age to whom this variable applied. The percent of these households which had a child with severe malnutrition was 9.6%, with moderate malnutrition 19.1%, and with normal children 71.3%.

Socio-Economic Findings

The results for the differences among socio-economic variables in the zones are presented in Table 10.

Household Characteristics

Of the total number of persons included in the study (6686), 54% were adults and 46.0% were children (aged 0 to 15 years). Seventy-three women were pregnant (1.0%), and 115 were lactating (3.2%). The number of pregnant women was lower than that reported by Smith (1982; 9.7%). Age distribution of the children in the present study was: 0-1 years 267 children (8.7%), 2-3 years 396 (12.9%), 4-6 years 565 (18.4%), 7-9 years 608 (19.8%), 10-12 years 653 (21.2%), and 13-15 years 585 (19.0%).

The average household size was 6.2. This was less than that reported by Brown (1977) or Sebrell (1972) where findings ranged form 7.6 to 8.0 but similar to Smith's findings of 6.4.

Education

Differences among the three zones were examined for the illiteracy rate and the highest grade completed in school of the head of the household and the mother. Significant differences in illiteracy were found between the dry and the humid zone. The humid zone had more illiterates than the other two zones. There was no difference among the zones in the number of years of schooling completed by either the head of the household of the mothers. The number of people

Table 10: Adjusted means of socio-economic variables and differences between zones

Variable	Zone: dry (1)	Zone: semi-humid (2)	Zone: humid (3)	p-value
family size	5.87 B C	6.31 A	6.50 A	0.0148
have children (%)	36.56 B C**	41.12 A	44.27 A**	0.0001
completed grade of father	2.29	2.17	2.02	0.2394
completed grade of mother	2.35 C	2.11	2.04 A	0.1168
illiterate (%)	29.09 C*	34.22	39.81 A*	0.0018
income category	3.56 B	2.99 A C*	3.62 B*	0.0004
per capita income (US $)	297.57 B*	228.59 A* C	279.70 B	0.0007
land holdings	2.21 C**	2.37 C**	2.99 A** B**	0.0001
expense category	4.21 C	4.14 C*	4.72 A B*	0.0003
children: nude (%)	23.78	28.25 C*	17.45 B*	0.0023
torn clothing (%)	17.31 C	18.30 C	25.02 A B	0.0313
barefoot (%)	48.56 B* C	64.11 A* C**	40.41 A B**	0.0001

A-A, B-B or C-C: significant differences at the $p \leq 0.05$ level
* : $p \leq 0.001$
** : $p \leq 0.0001$

above school age (7-14 years) who could not read or write was 1233, thus the illiteracy in this sample was 34.4%. This is in agreement with the reported national illiteracy, a national illiteracy rate of 32%, but is less than that reported in the Encyclopedia of the Third World (1978) (49% of the population over 25 years with no schooling). In the present study, the number of people per household above 14 years of age who could not read or write ranged from zero to nine with an average of 1.1.

The total number of school aged children was recorded as 1343 - although the estimated number of children between 7 and 14 years of age was 1651. However, 1.25 children per household were reported to be of school age (range zero to nine). Of the 333 households (31.0%) who gave reasons why their children did not attend school, 12.6% (n=42) declared that lack of resources for books, uniforms, shoes, etc. was the reason, 5.4% (n=18) that children do not like to go to school, 3.3% (n=11) that school was too far away, 2.7% (n=9) that children were needed at home to work, 1.8% each (n=6) that there was no school or there was lack of courses, 0.6% (n=2) that school teachers were disliked, and 71.8% recorded other reasons.

School is compulsory for seven years - from age 7 to 14, although schooling can last 12 years. The highest grade passed by the heads of the family and the mothers averaged only 2.2. Considering only those who attended school (31.3% of the heads of households and 32.3% of the mothers), the average years completed was 3.5 for both,

males and females. Table 11 shows the percent of the heads of the households and the mothers which accomplished the first to the eighth grade. Those completing the eighth grade (3.2%) are less than the 4.3% of the population over 25 that have completed the eigth grade as reported by the Encyclopedia of the Third World (1978).

Table 11: Heads of households and mothers having accomplished the first to the eighth grade of school (in %)

	grades 1	2	3	4	5	6	7	8
head of household	3.4	11.0	24.8	8.2	7.3	2.4	1.0	3.2
mother	3.3	10.5	26.8	9.4	6.2	2.6	0.7	2.8

Awareness

Because Cravioto (1973) and MacCorquodale (1977) found that ignorance and awareness were associated with malnutrition, these factors also were examined in the present study. The results are presented in Table 12. More than half of the people in the dry zone (59.3%) felt very good or good about their situation and only approximately one-third did so in the semi-humid (37.0%) and the dry zone (27.6%).

On a scale of 1 - very good - to 4 - very bad - most people were not very satisfied about their situation. The average score was 2.6, with 59% felt feeling 'bad' or 'very bad'. The basic need perceived for the household was food

(65.8%), followed by housing (12.6%), and clothing (3.0%).

Table 12: Adjusted means of attitudional variables and differences between zones

Variable	Zone: dry (1)	Zone: semi-humid (2)	Zone: humid (3)	p-value
feeling about situation	2.43 B** C**	2.68 A** C	2.78 A** B	0.0001
need of food	1.53 C	1.48 C	1.36 A B	0.0081
need of housing	2.99	2.93	2.98	0.6367
need of clothing	3.31 C	3.41 C	3.54 A B	0.0047

A-A, B-B or C-C: significant differences at the $p \leq 0.05$ level
* : $p \leq 0.001$
** : $p \leq 0.0001$

Economy

There were significant differences among the zones in income, per capita income, land holdings and expenses. Incomes in the dry zone and the humid zone were significantly higher than these in the semi-humid zone. The same was true for the per capita income (dry zone US $ 297.57, humid zone US $ 279.70, and semi-humid zone US $ 228.59). Land holdings were significantly ($p \leq 0.0001$) highest in the humid zone compared with the dry and the semi-humid zone. Also the expenses were significantly higher in the humid zone (average category 4.72) than in the dry (4.21), and the semi-humid zone (4.14).

The average household income was 1450 pesos per year. The average annual per capita income was 269 pesos. Household expenses averaged US $ 2,000 and were unexpectedly higher than income. This discrepancy might be due to underreporting of income from cash crops, gardens, casual jobs or intentional underestimation to avoid taxes. The mean area of land held was 50 tareas (3.15 hectares). This was higher than the averages reported by Brown (1977), which were 0.5 hectares of their own land and 1 hectare sharecropping, but lower than an average of 5 hectares, reported by Smith (1982).

The average annual per capita income found in the present study (US $ 269) was nearly the same as that reported by Sebrell (1972; US $ 263). The findings of Brown (1977) on a per capita basis would be approximately US $ 110. Thus, Brown's findings were lower than the ones found in the present study. Also, her findings for expenses, calculated for a 6.2 member household (US $ 620), were lower than the ones found in the present study (US $ 2000). The land holdings in the present study (3.15 hectares) were found to be between the values reported by Smith (1982; 1.3 hectares of 80% farmers, and 19.6 hectares average by those, possessing more than 6.3 hectares (100 tareas)), but closer to the value given for the majority of the farmers. But they are by far more than the reported averages by Brown, which are 0.5 hectares of own land and/or 1 hectare sharecropping.

Housing

The characteristics of the houses in the dry and the humid zone were a zinc roof, and in the semi-humid zone a cana roof and earth floors. Most of the roofs were zinc (59.3%), or cana (palm leaves 36.1%), followed by wood (2.3%), yagua (bark of the royal palm, 1.2%), and cement (1.1%). The majority of the walls was constructed with wood siding (79.6%). Combined wood with cement blocks (12.9%), cement blocks (4.0%), yagua (1.7%), wooden poles (1.1%), or carton (0.7%) were other materials used for walls. The floors consisted of wood and cement (72.8%), earth (24.7%) or terrazo (2.5%). The findings were similar to those reported by Smith (1982) in the same area. Houses were similar in the three zones except that in the dry and humid zone zinc roofs predominated while in the semi-humid zone more houses had cana roofs and an earth floor.

Clothing

The three zones were similar in the number of children being nude, barefoot, or wearing torn clothes. Of the 1543 children below 9 years of age who were present at the time of the interview, 372 (24.1%) were nude, 372 (24.1%) wore torn clothes, and more than half of them (898, 58.5%) were barefoot. Only 172 children were both nude and barefoot. These findings were similar in all three zones.

Occupation

There were 3034 people (84.5%) of all adults who had an occupation, The most frequently reported occupation was agriculture related (46.0%), followed by skilled and unskilled laborers such as craftsman, mason, cassava worker, seamstress, charcoal maker, wood cutter, and vendor (31.5%). Public and private employment in business, and commercial enterprises occupied 10.6%, which 3.0% were helping the family in productive activities, and domestic work, and 8.9% were engaged in other activities, such as student, peddler, or living or working in New York.

In the humid zone slightly more people were working in business, commercial, and public or private employment than in the other zones. More people in the semi-humid zone were working in agriculture, while the dry zone had mor ore relatives working in New York.

Inferential Findings

Relationships between the dietary intake, dietary pattern variables, malnutriton, and socio-economic variables will be presented in this section.

General relationships between the variables

Correlation coefficients are considered as to be good, when they exceed 0.8. In larger samples, such as this one, correlations of 0.4 are excellent and even those of 0.2 may be significant. In this study, correlations of 0.2 were significant on the $p \leq 0.0001$ level. Significant correlation coefficients for the dietary variables are listed in Table 13.

Table 13 : Correlation coefficients of dietary variables significant at $p \leq 0.0001$

	NAR prot.	NAR vit.A	NDR prot.	NDR vit.A	#food items	diet. qual.	diet. divers.
NAR cal	0.783	0.256	n.s.	n.s.	0.257	n.s.	0.295
NAR prot.		n.s.	0.575	n.s.	0.348	0.263	0.245
NAR vit.A			n.s.	0.848	n.s.	0.506	n.s.
NDR prot.				n.s.	0.302	0.255	n.s.
NDR vit.A					n.s.	0.473	n.s.
# food items						0.326	0.625
diet. quality							n.s.

n.s.: not significant at $p \leq 0.0001$

A highly significant Pearson Correlation Coefficient ($r=0.783$) was found between the NAR's for calories and protein, and a correlation ($r=0.256$) between calories and

vitamin A. The NAR for calories was slightly correlated with the diversity score (r=0.295) and the number of food items consumed (r=0.257). The NAR for protein was correlated with protein density (r=0.575). Both, NAR and NDR for protein were correlated with the number of food items consumed (r=0.348 and r=0.302, respectively), and the dietary quality (r=0.263 and r=0.255). The NAR for protein was also correlated with diversity (r=0.245).

The NAR for vitamin A was highly correlated with its density (r=0.848). The NAR for vitamin A and the vitamin A density were highly correlated with the dietary quality score (r=0.506 and r=0.473, respectively).

There was a correlation coefficient of 0.625 between the number of consumed food items and the dietary diversity score. A correlation (r=0.326) also was found between diversity and the dietary quality.

Vitamin A NAR was more highly correlated with vitamin A density than protein NAR was with protein density. One factor influencing the correlation between NAR's and NDR's may be the amount consumed. Households that consumed vitamin A rich foods such as sweet potatoes tended to consume high amounts, while protein rich foods were always consumed in small amounts. A slight correlation between the degree of malnutrition among children and the number of food items was found (r=0.175).

A correlation of 0.389 was found between the grade completed by the head of the family and the highest grade

completed by the mother. The higher the educational level of the father or the mother the lower the amount of illiteracy in the family (r=-0.414 and r=-0.441, respectively).

The need for housing was highly negatively correlated with the need for clothing (r=-0.602). How the people felt about their situation correlated with the need for food (r= -0.203), protein density (r=-0.222), and the number of food items consumed (r=0.235). Thus, people who considered their situation as bad had poorer diets (low protein density and less food items). They also valued their need for food as higher. This supports Cravioto's (1973) and MacCorquodale's (1977) findings, that ignorance and awareness also seem to be associated with malnutrition.

Correlation coefficients between economic, sociologic, and dietary intake variables are presented in Table 14. There were positive correlations between income and expenses (r=0.422), income and land holdings (r=0.331), and expenses and possessions (r=0.402). Income and expenses were positively correlated with the number of persons in the household (r=0.204 and r=0.350, respectively).

A slight positive correlation was found between expenses and the NAR for protein (r=0.200), protein density (r=0.221), dietary quality (r=0.252), dietary diversity (r=0.221), and the number of food items consumed (r=0.344). Household income correlated slightly with the protein density (r=0.224), and the number of food items (r=0.227). But income per person correlated with the NAR for protein

(r=0.325), and the peoples' feeling about their situation (r=-0.215). Land holdings were not correlated with any of the other socio-economic or dietary variables. Thus, the variable which correlated most with dietary variables was expenses. No significant correlations were found between the education and income.

Table 14: Significant correlation coefficients between economic, sociologic, and dietary intake variables

variables	expenses	income	income/cap.
income	0.422	--	*
land holdings	0.402	0.331	n.s.
NAR protein	0.200	0.224	0.325
NDR protein	0.221	n.s.	n.s.
dietary quality	0.252	n.s.	n.s.
dietary diversity	0.221	n.s.	n.s.
# food items	0.344	0.227	n.s.
household size	0.402	0.350	n.s.
feeling about situation	n.s.	n.s.	-0.215

* : not examined, since income per capita is a function of income
n.s.: not significant at $p \leq 0.0001$

Correlation coefficients between the housing, dietary, attitudional, and economic variables are presented in Table 15. Roof materials were highly correlated with floor materials (r=0.532), and moderately correlated with wall materials (r=0.340). Wall and floor materials also were correlated (r=0.320). There were slight negative correlations between the roof material and the NAR for vitamin A (r=-0.255), the roof material and vitamin A density (r= -0.239), and the floor material and protein density (r= -0.211). Feeling about the situation was positively

Table 15: Significant correlation coefficients between housing condition, dietary, economic, and awareness variables

variables	roof	wall	floor
roof	--	0.340	0.532
wall	0.340	--	0.320
NAR vitamin A	-0.255	n.s.	n.s.
NDR protein	n.s.	n.s.	-0.211
NDR vitamin A	-0.239	n.s.	n.s.
dietary diversity	-0.204	n.s.	n.s.
feeling about situation (awareness)	n.s.	n.s.	0.239
income	-0.259	n.s.	-0.269
expenses	-0.251	n.s.	-0.325
land holdings	-0.220	n.s.	-0.245

n.s. : not significant at $p \leq 0.0001$

correlated with the floor material (r=0.239). Negative correlations also were found with economic variables. The roof material correlated with income (r=-0.259), expenses (r=-0.251), and land holdings (r=-0.220); floor material correlated with the same variables (r=-0.269, r=-0.325, and r=-0.245, respectively), which indicated that with the increase of economic variables the quality of the houses improved.

In Table 16 the significant correlation coefficients between clothing and other variables are presented. The percentage of barefoot children was correlated with the percentage of nude children (r=0.332) as well as with the percentage of children with torn clothes (r=0.313). The percentage of children who were nude, barefoot or had torn

clothes was only slightly correlated with the housing conditions: nude children with floor material (r=0.214), barefoot children with roof material (r=0.225), and barefoot children with floor material (r=0.225). This suggested that as housing conditions deteriorated, children were more likely to have poor or no clothing.

Table 16: Significant correlation coefficients between clothing and housing

variables	nude	torn clothes	floor	roof
nude	--	n.s.	0.214	n.s.
barefoot	0.332	0.313	0.225	0.225

n.s.: not significant at $p \leq 0.0001$

Dietary Determinants of Malnutriton

Differences between severely or moderately malnourished or normal children and the dietary variables were tested. Households were classified according to how well they met the dietary recommmendations (below 66%, 66-100%, and exceeding 100%). Only a few of the findings were significant. Protein density (p=0.260) and dietary quality (p=0.310) differed slightly among the three classifications of nutritional status. The p-value for the NAR for vitamin A was not quite significant (p=0.580).

The protein density of the household diets was more frequently below 1.0 in the severely malnourished group than in the other groups. As protein density in their diets increased, preschool children were less malnourished. A

comparison of nutritional status with dietary quality showed that households with moderately malnourished children had the poorest dietary quality scores followed by households with severely malnourished children. However, as many households with severely malnourished children as with normal children had the highest dietary quality score. The highest NAR for vitamin A was found in households with moderately malnourished preschoolers. This might be due to the fact that most of the malnourished children were in the humid zone, which had the highest consumption of vitamin A.

Relationships Between the Dietary Patterns and Dietary Intake

Dietary patterns included dietary quality, dietary diversity, and the number of different food items consumed. The best correlation coefficients ($r=0.506$ for the NAR of vitamin A, and $r=0.433$ for NDR of vitamin A) were between dietary quality and both of the vitamin A related variables. Other significant correlations were between the number of food items and protein related scores ($r=0.336$ for NAR of protein, and $r=0.320$ for the NDR of protein). These results were supported by the contingency or Chi-Square tables.

When the dietary intake improved, scores of all dietary pattern variables also improved. The only exception was that more households with the lowest dietary pattern scores were found to have good NARs and NDRs of vitamin A than low NARs and NDRs. This might be due to the fact that some

households which consumed foods high in vitamin A (mostly sweet potatoes) reported only this food in high quantities on the 24-h dietary recall. This resulted in a low dietary pattern score, but a high vitamin A intake.

Analysis of variance showed, that the dietary patterns affected the dietary intake for most dietary variables (Table 17). A significant difference among the means of the seven dietary quality patterns was found for all NAR's and NDR's. The highest variance (r^2=0.4175) was found for protein density. The means for dietary diversity were significantly different between the NAR's of calories, protein, and protein density. Here, the highest variability was found for the NAR of calories (r^2=0.0937). The results for the different numbers of food items consumed were

Table 17: Results of the analysis of variance between the independent dietary pattern variables and the dependent dietary intake variables (NARs and NDRs)

	NAR			NDR	
	energy	protein	vit.A	protein	vit.A
diet. quality	***	***	**	***	***
F-value	5.24	17.9	4.46	25.4	5.53
r^2	0.0287	0.0919	0.0252	0.4175	0.0310
diet. diversity	***	***	n.s.	***	n.s.
F-value	12.17	8.47	1.39	6.43	0.44
r^2	0.0937	0.0672	0.0120	0.0518	0.0038
# food items	***	***	n.s.	***	n.s.
F-value	8.71	14.93	1.69	17.50	1.35
r^2	0.0760	0.1237	0.0161	0.1420	0.0129

*** : $p \leq 0.0001$
** : $p \leq 0.001$
n.s.: not significant, $p > 0.05$

similar. Although, the highest variability found here was between the NAR's and the NDR's of protein.

These findings suggest, that the number of food items consumed and dietary quality score may be an indicator of protein intake while dietary diversity may be a better indicator of the caloric intake of the households in this sample.

Socio-Economic Determinants of Dietary Intake

The relationships among the socio-economic variables and the dietary intake variables (NAR, NDR, and MAR) were analyzed with regression analyses (Table 18). The multiple regression analysis expresses the dependency between an independent variable and a dependent variable. When socio-economic and attitudional variables were included in multiple regression equations more of the variance in the dependent variables energy NAR, protein NAR, and protein density was explained than in the other dependent variables. The highest p-values were found for the NAR of energy and, in decreasing order, household size, expenses, land holdings, income per person, and the need of housing. Approximately the same results were found for the NAR of protein and, again in decreasing order, expenses, household size, income per person, and possessions. A significant contribution to the variance of the vitamin A NAR was made only by the percent of barefoot children. Protein density had significant contributions from the need of food, the feeling about the situation and the grade in school accomplished by

Table 18: Probability findings (results) of regression models testing the effects of socio-economic variables on dietary adequacy and density ratios

independent variable	dependent variable				
	NAR energy	NAR protein	NAR vit.A	protein density	vit. A density
family size	0.0001	0.0064	0.5524	0.5095	0.2432
% children	0.4226	0.0743	0.0603	0.0520	0.1458
grade father	0.9298	0.1861	0.8218	0.0694	0.6096
grade mother	0.7046	0.0974	0.4351	0.0347	0.4127
% illiterate	0.4258	0.8547	0.5266	0.9609	0.2327
expenses	0.0002	0.0019	0.8646	0.0803	0.9273
income	0.0625	0.1464	0.3910	0.3728	0.6084
income/person	0.0279	0.0103	0.8775	0.9582	0.9176
land holdings	0.0004	0.0249	0.2428	0.7736	0.6519
feel situat.	0.9280	0.4299	0.7977	0.0025	0.8366
need of food	0.1677	0.2608	0.7495	0.0020	0.7700
need housing	0.0496	0.3392	0.2567	0.7675	0.5796
need clothing	0.6602	0.4399	0.3194	0.7161	0.2760
% nude	0.5897	0.9474	0.2922	0.5199	0.3447
% torn cloth.	0.4407	0.5003	0.3294	0.6860	0.3358
% barefoot	0.9701	0.3039	0.0223	0.1720	0.1000
F-value	6.167***	5.842***	1.055	4.535***	0.974
r^2	0.1979	0.1894	0.0405	0.1535	0.0375

*** : $p \leq 0.0001$
==== : $p \leq 0.001$
---- : $p \leq 0.05$

greatest contribution to the variance was made by household size, as well as the economic variables, especially expenses.

The housing variables showed significant differences between wall and floor material (Table 19). The means of the vitamin A NAR and the vitamin A density were dependent on the wall material. Only protein density was dependent on the floor material. The occupation exerted an influence on the protein density and the NAR of protein.

The stepwise multiple regression analysis (Table 20) assumes, that the effects of variables can be added together to explain variance in the dependent variable. Thus, in such a model, a variable enters the model according to its related contribution to the NAR, NDR, or MAR value. This contribution is denoted by the initial r^2 value and the increase in r^2 with every step. All variables had to have a significance level of 0.05 in order to enter or to remain in the equation. In the SAS stepwise regression model only the variable which contributed the most will enter, if variables show interaction. A variable can subsequently be eliminated from the model if after the introduction of other variables it no longer makes an important contribution.

In the stepwise regression analysis the most significant contribution to the variance in the calorie NAR was made by household size, followed by expenses, and land holdings. This was similar to the findings of the multiple regression analysis. In a stepwise regression equation with

Table 19: General Linear Model Procedure, analyzing the effects of selected socio-economic variables on dietary adequacy and density ratioss

variables	F-value				
	NAR calories	NAR protein	NAR vit.A	protein density	vit. A density
zone	20.17***	4.81*	3.75	6.51*	3.86
roof	1.41 ns.	1.07 ns.	0.92 ns.	2.60	0.92 ns.
wall	2.76	2.47	5.45***	1.24 ns.	5.22
floor	0.50 ns.	0.83 ns.	0.19 ns.	7.57**	0.59 ns.
job	3.52	4.81*	0.79 ns.	9.37***	1.54 ns.
total F-value	4.39***	3.45***	2.72**	6.53***	3.03***
r^2	0.0657	0.0524	0.0426	0.0947	0.0473

*** : $p \leq 0.0001$
** : $p \leq 0.001$
* : $p \leq 0.01$
ns. : $p > 0.05$, not significant

Table 20: Changes in the Stepwise regression equations testing socio-economic and dietary variables

	equation 1[a]		equation 2[b]	
dependent variable	independent variable[c]	cummulat. r^2	independent variable	cummulat. r^2
NAR energy	family size	0.0848	# food items	0.0870
	expenses	0.1512	family size	0.1856
	land holdings	0.1750	land holdings	0.2129
			expenses	0.2275
			diet. quality	0.2356
NAR protein	income/person	0.0992	# food items	0.1075
	family size	0.1129	income/person	0.1794
	expenses	0.1504	family size	0.2033
	need housing	0.1597	expenses	0.2152
	land holdings	0.1691	need housing	0.2231
	grade mother	0.1758	land holdings	0.2281
			income	0.2338
			% children	0.2380
NAR vitamin A			diet. quality	0.0168
			income/person	0.0246
protein-density	feel situat.	0.0599	# food items	0.1004
	need of food	0.0949	need of food	0.1438
	expenses	0.1165	feel situat.	0.1603
	grade mother	0.1267	income	0.1713
	income	0.1349		
vitamin A-density	family size	0.0104	diet. quality	0.0203
			family size	0.0309
MAR	income/person	0.0785	# food items	0.1909
	expenses	0.1054	family size	0.2453
	family size	0.1546	expenses	0.2753
	land holdings	0.1737	land holdings	0.2884
	feel situat.	0.1817	% barefoot	0.2993
	% children	0.1900	% children	0.3071
			income/person	0.3125
			need housing	0.3162

a: equation 1 = all socio-economic variables
b: equation 2 = all socio-economic variables together with the number of food items consumed and dietary quality
c: variables listed in order of entry into the equation

the protein NAR, the highest contributions to the variance in NAR of protein were made, in decreasing order, by income per person, household size, expenses, need for housing, land holdings, and the highest grade completed by the mother. A high contribution to the variance in protein density was made by the feeling about the situation, the need for food, expenses, highest grade completed by the mother, and income. This was similar to the results of the multiple regression analysis. The MAR had the highest contribution from income per person, expenses, household size, land holdings, feeling about the situation, and percent of children in the household. MAR also had the highest cummulative r^2, followed by the NAR's for calories and protein. Thus, more of the variance was explained in the MAR than in the other dependent variables.

In general, the results suggested, that household size and the economic variables contributed most to the variance in the dietary variables. Awareness, in form of feelings about the situation or of a basic need were more important than the educational variables. This is similar to the findings of Cravioto (1973) and MacCorquodale (1977), that in the Dominican Republic, income is truly an important determinator of malnutrition.

The second stepwise equation included the number of food items consumed, and dietary quality with the socio-economic variables. In this equation more of the socio-economic variables entered the model than in the first equation, and the cummulative r^2 became larger. The order

in which the variables had entered in equation 1 changed slightly in equation 2. The number of food items consumed was most important for all of the dependent variables in the second equation, except the vitamin A dependent variables. In general, in addition to the number of food items consumed, the most important variables in equation 2 were household size and the economic variables.

SUMMARY AND CONCLUSIONS

The present investigation of the dietary intake and related socio-economic factors in the Dominican Republic included 1073 households with 6686 members. The average household size was 6.2, which was less than that reported by Brown (1977), and Sebrell (1972). The dry zone had significantly smaller households than the semi-humid and the humid zone.

In the 24-hour household dietary recall, 77 food items were recorded. The most frequently consumed food items by all households were not identical to the food items consumed in the largest amounts. The average consumption per household per day was 8.4 different food items, with the significantly highest score (8.95) in the dry zone. The average diversity score was 6.3, with the lowest score occuring in the semi-humid zone. The dietary quality score showed balanced, or 'satisfactory' diets in 40% of all households. The vitamin-rich protection group was not represented in 16.2% of the diets of all household. Alcohol consumption did not appear to impair dietary intake.

The average household intake was: 11,522 kcal, 268 g protein, and 2,682 mcg vitamin A. The average NAR for calories was 86.3, 95.3 for protein, and 74.1% for vitamin A. All NAR values in the dry and semi-humid zones were significantly lower than the ones in the humid zone. Actual dietary intake, as well as the NAR values, was higher than

those reported by Sebrell (1972) and Klipstein (1973). Only the mean protein score was approximately similar. The protein density ratio averaged a satisfactory 1.0920. A slight difference was found between the dry zone and the humid zone, where the humid zone had significant lower ratios. Vitamin A density averaged 0.7406. Significantly higher scores were observed in the humid zone than in other zones.

In general, the dietary intake in the Dominican Republic was found to be below the FAO recommendations, except for the humid zone, where protein and vitamin A intake exceeded the recommendations. The best dietary intakes, based upon NARs, were reported in the humid zone. The humid zone also had higher dietary diversity and dietary quality scores, but the smallest number of food items mentioned on the 24-hour recall. The best protein density score, and the second best vitamin A density score were found in the dry zone. The humid zone, on the other hand, had the best vitamin A density score, but the worst score for protein density. Although, residents in the dry zone consumed smaller amounts of a large number of different food items, the food had higher density ratios than in the other zones. Residents of the humid zone consumed larger amounts of fewer foods than those in the dry zone. These foods had a low protein density, but a surprisingly high vitamin A density. The semi-humid zone had the lowest values, except for the number of food items consumed and the protein density ratio, which was moderate. The high ratios for vitamin A (NAR and NDR) in the humid zone can be explained

by the high intake of sweet potatoes, which, in some cases, was almost the only food recorded in the 24-hour recall.

Beneficial combinations of foods that were found were as follows: 75.9% of all households combined rice with beans, 61.5% vitamin A rich foods with fats or oils, 73.3% protein rich foods with vitamin A rich foods, and 63.5% animal protein foods with vitamin A rich foods. Smith (1982) found a higher consumption of rice and beans (92%) than was found in this study.

For calories and protein, approximately one-third of the sample fell below 66% of the recommendations, one-third in between 66% and 100%, and one-third exceeded 100%. These data suggested that three-fifths of the households (62.6% for calories, 61.1% for protein) in the research area did not meet the recommendations for calories and protein. Intake of vitamin A was even less satisfactory: 90.3% were below 66% of the recommendations, 3.8% between 66% and 100%, and 5.9% above 100%. Thus, 94.1% did not meet the recommendations for vitamin A.

The prevalence of malnutrition was reflected in the results of the arm circumference measurements on 88% of the children. Severe malnutrition was found in 7.6% of the children, and 15.3% were moderately malnourished. The incidence of malnutrition was somewhat higher than that reported in other studies (Anderson, 1979; Sebrell, 1972; Smith, 1982), except Sebrell, who reported moderate malnutrition in 23% of children. The highest percentage of malnourished

children was found in the humid zone (61.9% severe and 48.4% moderate), which also had the highest NAR's, as well as the highest dietary quality and dietary diversity score. This suggests that the nutrients available in this zone for household consumption were adequate. The percentage of households which met the recommendations for each nutrient was higher in the humid zone than in any other zone. However, this zone then also had a higher percentage of households with a protein density ratio lower than 1.0, although their protein NAR was the highest found. One reason for the observed malnutrition in the humid zone may be that more households had a diet lower in protein density than that required by their growing children. Although only a few dietary variables were related to malnutrition, a low protein density ratio was found significantly more frequently in households with severely malnourished children. Households with low dietary quality scores also had significantly more severely and moderately malnourished children. Since the dietary quality scores had the highest variability for protein density, malnutrition in the humid zone may be related to diets with low protein density. The percent of animal protein in the total protein was also low in the humid zone, and high in the semi-humid zone.

The examination of socio-economic variables showed no clear pattern among the findings for each zone. The average size of households was 6.2 members with 3.36 adults and 2.86 children, which was lower than the number reported by Brown

(1977), and Sebrell (1972). The illiteracy rate was 34.4%, which agreed with other reports. There were 18.7% more children of school age than there were attending school. The average grade completed by the parents was low (2.2), porbably due in part to the Civil War in the 1960s which closed the schools for several years.

Attitudes and awareness about the situation of the people is considered to be a determinator of malnutrition. In this study three-fifth of the people felt bad about their situation, and their prior basic need was reported to be food. Relationships were found among attitudes and dietary variables. With increasing estimation of feeling bad about the situation, protein density and the number of different food items consumed was impaired, and the need for food was valued higher. Attitudional variables had the most contribution to the variance of protein density. This suggests, that probably increased awareness about the situation could improve the protein density of the diet and thus, could reduce malnutrition in children.

The average household income was US $ 1450 anually, and the per capita income US $ 269. This was similar to the findings of Sebrell (1972), but lower than that of Brown (1977). The expenses were US $ 2000 anually per household, which was lower than those reported by Brown. Land holdings averaged 3.15 hectares, similar to the findings of Smith (1982), but lower than those of by Brown. Correlation coefficients showed that as income increased, land holdings, expenses, family size, NAR's for protein, and number

of food items consumed also increased. There was also a positive correlation between expenses and protein density, dietary quality and dietary diversity. As per capita income increased the feeling about the situation improved.

The most characteristic materials for houses were a zinc roof, wood siding, and wooden or cement floors. This was similar to the report of Smith (1982). As housing conditions improved, some dietary variables also increased.

One-quarter of the children were nude or wore torn clothes and half of them were barefoot. There was a positive correlation between these variables and housing conditions.

Allmost all of the adults had an occupation. Most of them were engaged in agriculture. Other frequent occupations were craftmen, private or public employment, and business. Approximately 10% of all households had relatives in New York.

In general, the dry zone had the lowest number of members, the lowest number of children, the lowest illiteracy rate, and the highest protein density scores. The people estimated their situation as the best. The opposite was true for the humid zone. Most of the dietary intake and dietary pattern variables were best ion this zone, except for the protein density score. Although, the highest incidence of malnutrition was found in the humid zone. The fact that the humid zone had the best vitamin A scores, consumed large amounts of sweet potatoes, and had high NARs

of vitamin A in families with more than 13 members, suggests, that large households tend to eat frequently sweet potatoes and in high amounts. This would explain the high NAR of vitamin A in the humid zone as compared to both other zones. The need of food, which had the highest priority among food, housing, and clothing in all three zones, was even estimated as more necessary in the humid zone than in both other zones. Household income and income per capita were similar in the dry and the humid zone. The semi-humid zone was lowest in all variables, except for the percent of nude and barefoot children, which were the highest and the incidence of malnutrition, which was the lowest compared to the other zones.

Dietary variables were most influenced by household size, income, income per person, expenses, and land holdings. Awareness or feeling about the situation and the need for food predicted NAR, NDR, and MAR scores more than did the educational variables.

The final conclusion is that the dietary intake was not sufficient for a great part of the population in the Dominican Republic. A high incidence of malnutrition existed. Economic variables and household size were more important than any other socio-economic variable in predicting malnutrition. Also, the awareness variables were more important than educational variables in malnutrition. Dietary pattern scores were helpful in identifying insufficient intakes of selected nutrients.

This study showed that for an effective nutrition

intervention in the Plan Sierra area, rehabilitative and preventive programs may be of benefit. A rehabilitative program can improve the nutritional status of already malnourished children. This program can be implemented in the health clinics, which are available in this area. For a preventive program, the present study indicated nutrition education, to provide the people with a tool of how to use the available food as beneficially as possible, and what to feed their growing children. Because household size had the greatest impact on the dietary intake of the people, a family planning program might have a positive effect on decreasing household sizes, and thus, impoving dietary intake. Additionally, an improvement in the peoples' attitudes and their awareness about their actual situation also might have a beneficial effect on their nutrition, and, possibly also on decreasing household sizes. In addition to household size, the economic status of the households in this area seemed to be one of the important factors for inadequate nutrient intake. It might be suggested that the existing agricultural program in the Plan Sierra area should continue working to improve the families' economic situation.

Further studies are suggested using data about expenses rather than income, because expenses in this region seemed to be a more reliable variable for predicting malnutrition than income.

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Appendix 1: List of foods designated into the three food groups: consumption, protection, and energy

construction:	beans (3)	goat (61)
	beans, black (71)	hering (41)
	beans, white (22)	milk (4)
	beef (12)	milk, evap. (14)
	cheese, white (21)	milk, powd. (5)
	chicken (13)	pork (50)
	eggs (15)	rabbit (65)
	fish (55)	salami (33)
protection:	avocado (27)	lemon, sweet (48)
	banana (23)	lemonade (62)
	beet (24)	lettuce (30)
	cabbage (25)	mango (74)
	carrots (77)	onion (17)
	cassava (32)	orange, sour (7)
	celery (56)	orange, sweet (46)
	chayote (76)	papaya (36)
	corn (60)	pear (73)
	cucumber (35)	pigeon peas (34)
	egg plant (69)	pineapple (63)
	fruit salad (75)	pomegranate (68)
	garlic (49)	potatoes (54)
	grape juice (51)	sweet potatoes (57)
	green banana (11)	tomato (20)
	guanabano (70)	tomato paste (43)
	guave (31)	winter squash (72)
	lemon, sour (26)	
energy:	bread (10)	with coconut (29)
	butter (59)	noodles (39)
	chocolate (18)	oats (19)
	cookie (40)	oil (8)
	flour (47)	pear juice (37)
	honey (53)	rice (2)
	ice cream (38)	spaghetti (9)
	milk, cond. (58)	sugar (1)
	milk-sugar candy (28)	yam (52)
	milk-sugar candy,	yucca (6)
other:	beer (67)	rum (44)
	coffee (16)	salt (42)
	corn flour (66)	tablets (45)
	maggie soups (64)	

(#) : number, attached to each food

Appendix 2: Food items recalled by percent of households (HH), and the rankorder for each food item: listed by total sample and for each zone

food no.	food item	total % of HH (n=1073)	total rank	zone 1 % of HH (n=339)	zone 1 rank	zone 2 % of HH (n=370)	zone 2 rank	zone 3 % of HH (n=364)	zone 3 rank
1	sugar*	96.8	1	95.9	1	97.0	1	97.5	1
2	rice*	90.6	2	94.5	2	85.9	2	91.5	2
3/22/71	beans*	78.2	4	79.9	4	73.5	4	81.3	4
4	milk (cows, 3.5%)*	46.8	7	63.7	6	50.0	6	27.7	11
5	powd. milk	11.6	17	8.8	20	4.1	26	22.0	12
6	yucca*	52.7	5	67.8	5	63.2	5	28.0	10
7/46	orange*	41.2	8	38.1	9	34.3	9	51.1	7
8	oil*	81.5	3	84.4	3	76.2	3	84.3	3
9/39	spaghetti/noodles*	48.7	6	44.5	7	42.0	7	59.6	6
10	bread*	34.0	10	32.7	11	37.6	8	31.6	9
11	green banana	20.6	12	33.6	10	23.0	12	6.0	18
12	beef	17.9	13	20.1	13	16.8	14	17.0	13
13	chicken	11.0	18	13.0	17	10.3	19	10.0	14
14	evap. milk	3.7	27	1.8	43	4.9	24	4.4	24
15	eggs*	37.4	9	40.4	8	30.3	10	41.8	8
16	coffee	15.9	14	16.2	15	26.8	11	4.7	22
17	onion	9.4	20	7.1	21	16.2	15	4.7	22
18	chocolate (beverage)	1.5	39	3.2	27	1.1	41	0.3	45
19	oats	2.2	34	3.5	25	2.4	32	0.8	37
20	tomato	2.8	32	3.2	27	3.5	28	1.6	33
21	white cheese	6.8	23	12.4	18	6.2	22	2.2	30
22	banana*	25.5	11	2.4	33	3.5	28	69.5	5
24	beet	0.9	46	1.2	48	1.4	40	0.3	45
25	cabbage	1.2	44	2.4	33	0.8	43	0.5	39
26/48	lemon	9.5	19	15.9	16	10.3	19	2.7	28
27	avocado	11.7	16	18.3	14	13.0	17	4.4	24
28/29	milk-sugar candy	9.3	21	9.7	19	12.0	18	6.3	17
30	lettuce	0.8	48	2.1	38	0.3	50	0.3	45
31	guave	2.4	33	3.2	27	1.1	41	3.0	27
32	casava	13.3	15	20.4	12	17.8	13	2.2	30
33	salami (beef)	2.9	31	2.7	32	3.5	28	2.5	29
34	pigeon pea	1.7	38	3.2	27	1.6	39	0.3	45
35	cucumber	0.2	58	--	--	0.3	50	0.3	45
36	papaya	0.8	50	1.8	43	0.3	50	0.3	45
37	pear juice	--	--	--	--	--	--	--	--
38	ice cream (10% fat)	1.4	41	2.4	33	2.0	36	--	--
40	cookie	3.5	28	1.8	43	3.5	28	5.2	20
41	hering	0.8	48	1.8	43	0.5	47	0.3	45
42	salt	9.0	22	5.6	22	13.8	16	7.4	15
43	tomato paste	3.1	30	2.1	38	7.0	21	--	--
44	rum	0.9	46	2.4	33	--	--	0.5	39
45	tablets	1.2	44	2.4	33	0.8	43	0.5	39
47	flour	4.8	24	3.2	27	4.1	26	6.9	16
49	garlic	3.4	29	4.4	24	4.9	24	0.8	37
50	pork	2.0	35	2.1	38	2.4	32	1.4	34
51	grape juice	0.4	53	0.9	50	0.3	50	--	--
52	yam	1.8	37	--	--	0.3	50	4.9	21
53	honey	0.2	58	--	--	--	--	0.5	39
54	potatoes	1.4	41	2.1	38	2.0	36	0.3	45
55	fish	4.1	25	5.0	23	5.4	23	1.9	32
56	celery	0.4	53	--	--	--	--	1.1	36
57	sweet potatoes	3.9	26	3.5	25	2.4	32	5.3	19
58	condensed milk	0.3	56	0.6	52	0.3	50	--	--
59	butter	--	--	--	--	--	--	--	--
60	corn	2.0	35	1.2	48	0.8	43	3.3	26
61	goat	0.7	51	0.9	50	0.5	47	0.5	39
62	lemonade	1.5	39	2.1	38	2.2	35	0.3	45
63	pineapple	0.1	63	--	--	0.3	50	--	--
64	maggie soups	1.3	43	0.6	52	2.0	36	1.4	34
65	rabbit	0.2	58	--	--	0.3	50	0.3	45
66	corn flour	0.1	63	0.3	55	--	--	--	--
67	beer	0.3	58	--	--	--	--	0.5	39
68	pomegranate	0.1	63	0.3	55	--	--	--	--
69	egg plant	0.7	51	1.8	43	0.3	50	--	--
70	guanabano	0.1	63	0.3	55	--	--	--	--
72	winter squash	0.4	53	0.3	55	0.8	43	--	--
73	pear	0.3	56	0.6	52	0.3	59	--	--
74	mango	0.2	58	--	--	0.5	47	--	--
75	fruit salad	--	--	--	--	--	--	--	--
76	chayote	0.1	63	0.3	55	--	--	--	--
77	carrots	0.1	63	0.3	55	--	--	--	--

*: the eleven most frequently consumed food items, included in the diversity score

Appendix 3: Mean amounts consumed per day, standard deviation, and frequencies, from the ten foods highest in consumption for an average household (6.2 persons, HH), listed total and by zone

rank	total (n=1073)				zone 1 (n=339)			
	food no.*	g/HH	std.dev.	freq.	food no.	g/HH	std.dev.	freq.
1	57	2713.1	2268.0	(42)	6	2584.8	1550.6	(232)
2	6	2680.9	1731.0	(569)	57	2348.6	1359.7	(12)
3	56	2070.1	1003.0	(4)	54	2272.3	1960.4	(7)
4	52	1882.9	1546.3	(19)	60	1591.5	1548.8	(4)
5	54	1648.0	1534.5	(15)	2	1011.3	404.9	(321)
6	60	1413.6	899.6	(23)	13	915.7	459.4	(44)
7	2	1101.7	580.9	(977)	12	900.2	460.7	(68)
8	13	1045.9	505.3	(118)	34	706.2	400.5	(11)
9	23	1022.4	878.5	(315)	41	639.2	1071.4	(6)
10	12	908.9	642.3	(193)	50	610.1	450.0	(7)

rank	zone 2 (n=370)				zone 3 (n=364)			
	food no.	g/HH	std.dev.	freq.	food no.	g/HH	std.dev.	freq.
1	6	2640.6	1600.8	(235)	57	3181.2	2808.6	(21)
2	57	2107.4	1706.9	(9)	6	2993.4	2301.4	(102)
3	14	1140.8	1680.2	(18)	54	2812.3	---	(1)
4	72	1098.0	789.9	(3)	56	2070.8	1003.8	(4)
5	2	1086.2	556.8	(321)	52	1960.4	1556.8	(18)
6	13	1010.6	385.6	(38)	60	1472.5	738.4	(16)
7	12	926.3	868.0	(63)	2	1204.0	717.3	(335)
8	60	861.2	817.8	(3)	23	1070.1	887.2	(294)
9	54	856.8	487.3	(7)	25	1000.7	421.0	(2)
10	65	843.8	---	(1)	12	900.2	548.1	(62)

* : 2 = rice
6 = yuca
12 = beef
13 = chicken
14 = evapor. milk
23 = banana
25 = cabbage
34 = pigeon peas
41 = hering
50 = pork
52 = yam
54 = potatoes
56 = celery
57 = sweet potatoes
60 = corn
65 = rabbit
72 = winter squash

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RELATION OF SELECTED SOCIO-ECONOMIC FACTORS
TO DIETARY INTAKE AND DIETARY PATTERNS
IN THE DOMINICAN REPUBLIC

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ABSTRACT

Selected socio-economic variables were studied in their relation to dietary intake and dietary patterns in the Dominican Republic. A survey of 1073 households was conducted in 1983 in an integrated agricultural project near Santiago, Dominican Republic. Relationships among socio-economic variables, attitudional variables , and Nutrient Adequacy Ratios (NAR), Mean Adequacy Ratios (MAR), and Nutrient Density Ratios (NDR) were analyzed using multiple regression statistics.

Three-fifth of the households did not meet the FAO-recommendations for calories and protein, and 94.1% for vitamin A. Moderate malnutrition, measured with the Shakir Strip, was found among 22.9% of the 1-5 year old children. A diet low in protein density was suggested as a possible cause of the malnutrition. Households with high vitamin A intake had a high consumption of sweet potatoes. As household size increased the NAR's decreased, although they improved again in the largest households. Household size and the economic varialbes, including income, income per person, expenses, and land-possessions, contributed most toward predicting NAR's, NDR's, and MAR's. Expenses were a greater indicator of nutrient intake than income. Attitudional variables were better predictors of dietary intake than educational variables.

These findings can be used to design a nutrition intervention that will increase the well being of rural families in the Dominican Republic